

GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF CONTRACT ADMINISTRATION
SPONSORED PROJECT INITIATION

ang

Date: 10/24/78

Project Title: Hydraulic Transients in Circulating Cooling Water Systems

Project No: E-20-650

Green Card (UNIV)

Project Director: Dr. C. S. Martin

Sponsor: Electric Power Research Institute

*6-1-84
4/30/83*

June 30, 1981

Agreement Period: From 10/1/78 Until 11/30/79 (Agreement Period)

Type Agreement: EPRI Project No. RP1342-1

Amount: \$90,000 (Partially funded at \$42,000 through 12/31/78)

Reports Required: Forecast of Expenditures; Monthly Project Status Reports; Monthly Financial Reports; Final Report

Sponsor Contact Person (s):

Technical Matters

John S. Maulbetsch (Project Manager)
Electric Power Research Institute
3412 Hillview Avenue
P. O. Box 10412
Palo Alto, CA 94303

Contractual Matters

(thru OCA)

Glen N. Barber, Manager —
Contract Negotiations
Electric Power Research Institute
3412 Hillview Avenue
P. O. Box 10412
Palo Alto, CA 94303

Defense Priority Rating: N/A

Assigned to: Civil Engineering (School/Laboratory)

COPIES TO:

Project Director
Division Chief (EES)
School/Laboratory Director
Dean/Director—EES
Accounting Office
Procurement Office
Security Coordinator (OCA)
Reports Coordinator (OCA)

Library, Technical Reports Section
EES Information Office
EES Reports & Procedures
Project File (OCA)
Project Code (GTRI)
Other _____

SPONSORED PROJECT TERMINATION/CLOSEOUT SHEETDate 8/11/86Project No. E-20-650School CEIncludes Subproject No.(s) N/AProject Director(s) C. S. Martin~~XXXX~~ / GITSponsor Electric Power Research InstituteTitle Hydraulic Transients in Circulating Cooling Water SystemsEffective Completion Date: 6/1/84 (Performance) (Reports)

Grant/Contract Closeout Actions Remaining:

☐ None☒ Final Invoice or Final Fiscal Report☒ Closing Documents☒ Final Report of Inventions ——— Sent Questionnaire to P.I.☒ Govt. Property Inventory & Related Certificate☐ Classified Material Certificate☐ Other _____

Continues Project No. _____ Continued by Project No. _____

COPIES TO:

Project Director
Research Administrative Network
Research Property Management
Accounting
Procurement/GTRI Supply Services
Research Security Services
Reports Coordinator (OCA)
Legal Services

Library
GTRC
Research Communications (2)
Project File
Other A. Jones
I. Newton
C. Stanford

(All dollar figures should be rounded to the nearest thousand)

E-20450

[illegible][illegible]

Difficulties still exist in obtaining approval from EPRI to set up subcontract between Georgia Tech and Michigan State University

*Review comments and instructions on the reverse side before completing report.

SIGNATURE (Contractor Representative)

4/10/79
DATE

FORECAST APPROVAL (EPRI Project Manager)

DATE _____

✓
x c. H. Becker

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

SCHOOL OF
CIVIL ENGINEERING

TELEPHONE:
(404) 894-2224

November 29, 1978

Electric Power and Research Institute
3412 Hillview Avenue
P. O. Box 10412
Palo Alto, California 94303

Subject: EPRI Project No. RP1342-1; Monthly Project Status and
Financial Report

Attention: Dr. John S. Maulbetsch

Gentlemen:

The first month of the contract has been devoted to making contractual arrangements with the two Subcontractors -- Michigan State University (services of Dr. D. C. Wiggert and graduate student) and Lockheed - Georgia (services of Mr. F. D. Lewis, Research Engineer) -- and the ordering of two flow meters for installation in the circulating water system of the Shoreham Nuclear Plant.

Personnel at Long Island Lighting Company and at Stone and Webster estimate the earliest start-up date to be April 1, 1979. A more realistic date may be early Summer 1979.

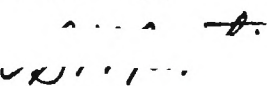
Our present schedule of activity is as follows:

<u>Dates</u>	<u>Activity</u>	<u>Location</u>
1/1 - 6/30	Initial Code Development	GIT and MSU
2/1 - 3/31	Dynamic Calibration of Flow Meters	GIT
4/1 - 5/30	Installation of Flow Meters	Shoreham
6/1 -	Field Testing	Shoreham
7/1	Code Verification	GIT and MSU

We anticipate that our computer code will be developed and operational by the time the field testing is initiated.

A copy of a Monthly Status Report is enclosed.

Sincerely,


C. S. Martin
Professor



CSM:bjj
Enclosure
cc: Dr. Wiggert

REPORT DATE: 12/1/78

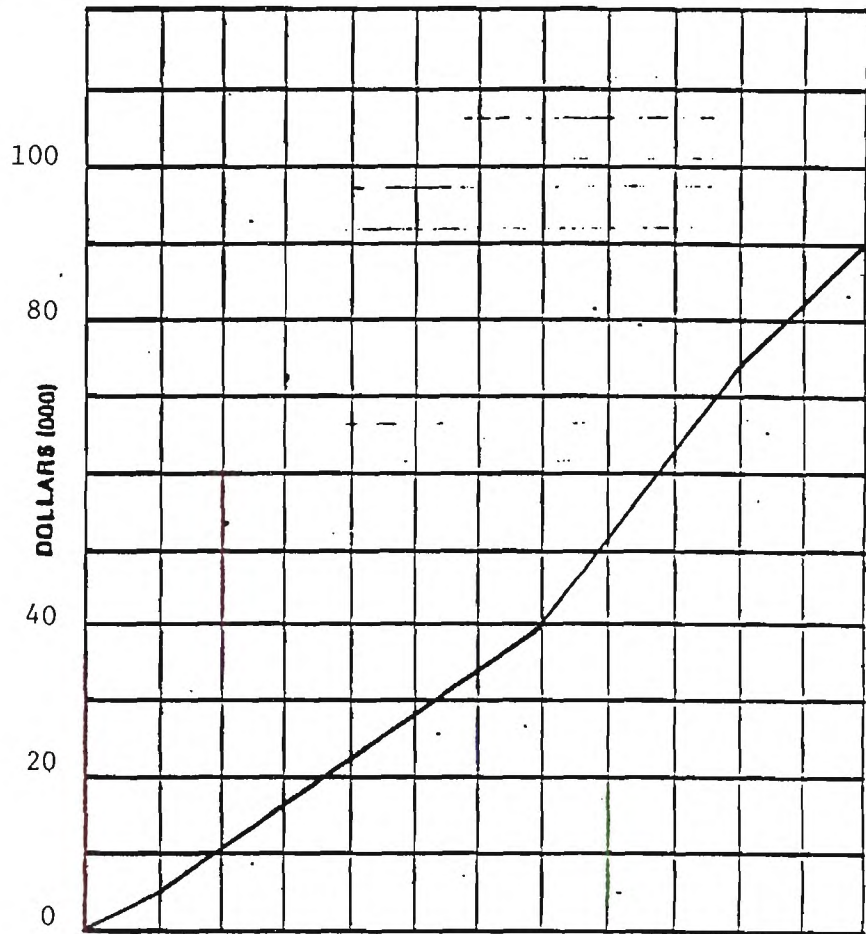
COST LEGEND

PLAN 0
ACTUAL 0
EST. TO COMPLETE \$ 90,000

STATUS LEGEND

 PLANNED
 SLIPPED
 (SOLID SYMBOLS INDICATE ACTUALS)

MILESTONE LEGEND



Year	1978	1979										
MON.	12/1	1/1	2/1	3/1	4/1	5/1	6/1	7/1	8/1	9/1	10/1	11/1

MILESTONES

[illegible]

REMARKS (Comment Briefly on Significant Items)

E 20-630

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

SCHOOL OF
CIVIL ENGINEERING

TELEPHONE:
(404) 894-

July 15, 1982

Dr. J.S. Maulbetsch
Electric Power Research Institute
3412 Hillview Avenue
P.O. Box 10412
Palo Alto, California 94303

Subject: Monthly Progress Report for EPRI Contract RP1342-1.
"Hydraulic Transients in Circulating Cooling Water Systems"

Dear Dr. Maulbetsch:

During the week of June 21-25, Dr. D.C. Wiggert of Michigan State University and I met with engineers and researchers of the Central Electricity Generating Board (CEGB) for the purpose of discussing at length their field test program on hydraulic transients in cooling water systems in several of their plants. The visit was very beneficial to our cause because (1) we were able to receive directly most of their test reports, (2) we met the man who actually conducted the tests at Grain Power Station (the plant that experienced a waterhammer event), and (3) we were able to discuss at length their test program and the generic problem in general.

We began the week with a meeting at the Leatherhead research facilities, where we met the following individuals:

Dr. David Jacobs (Numerical and analytical modelling)
Mr. Jeff Markham (Responsible for CEGB's waterhammer code development)
Mr. Mike Collins (Involved in frequency response measurement of cooling water systems)

Mr. Roger Smith (Coordinator from Barnwood facility and our host and guide)

Of particular interest was CEGB's philosophy of modelling condensers and the water boxes. The on-site frequency analysis of cooling water systems being conducted by Mr. Collins has some promise regarding the estimate of the total amount of free gas in the system, realizing that there remains the uncertainty of its origin.

On June 23rd Mr. Smith drove us to the island of Grain to meet Mr. Brian Davidson of the Littlebrook laboratory who conducted the transient tests at Grain Power Station in 1979 and 1980. We were able to inspect the system, gain first hand knowledge regarding the tests, and to receive the pertinent test reports.

In summary, our visit was quite fruitful, providing us with the necessary information to proceed with our respective analysis.

Sincerely,

C.S. Martin
C.S. Martin
Professor

CSM:dsg

cc: Dr. D.C. Wiggert

EPRI CONTRACT NUMBER RP <u>1</u> <u>3</u> <u>4</u> <u>2</u> - <u> </u> <u>1</u>	CONTRACTOR NAME AND ADDRESS Georgia Institute of Technology Atlanta, Georgia 30332
PERIOD OF PERFORMANCE From: <u>6</u> / <u>01</u> / <u>82</u> To: <u>6</u> / <u>30</u> / <u>82</u>	

Refer to instructions on reverse side;
all figures are to be shown in whole thousands.

Actual
Incurred
cost in the
current year
19 82

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Prior Year(s) Actual	(1)
1	1	1	2	2	5							90	
												Current Year Actual	
												12	(2)

Forecast to
complete the
current year
19 82

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Current Year Forecast	(3)
						4	4	2	2	2	1	15	

Forecast to
complete the
future year(s)

19 <u>83</u>	19 <u> </u>	19 <u> </u>	19 <u> </u>	Remaining Year(s)	Future Year(s) Forecast	(4)
18					18	

Grand total of lines (1) + (2) + (3) + (4)

Contract cost limitation thru amendment no.

135

135

Remarks. Comment on significant changes.

Note: Contract cost limitation = (1) + (2) + (3) + (4); if not, an explanation is required.

William (Professor)
Signature and Title (contractor representative)

7/5/82
Date

Signature (EPRI project manager)

Date

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

SCHOOL OF
CIVIL ENGINEERING

TELEPHONE
(404) 894.

August 4, 1982

Dr. J.S. Maulbetsch
Electric Power Research Institute
3412 Hillview Avenue
P.O. Box 10412
Palo Alto, CA 94303

Subject: Monthly Progress Report for EPRI Contract RP 1342-1
"Hydraulic Transients in Cooling Water Systems"

Dear Dr. Maulbetsch:

During the month of July 1982 effort was expended by myself and Mr. Naghash, a PhD student at Georgia Tech, to make operational the two-phase implicit code that was initially developed by Dr. P.V. Rao during his stay here in 1980-81.

Once the code is operational for the Shoreham configuration attempts will be made to adapt it to both the Grain and Torrens Island Power Stations.

Sincerely,

C.S. Martin

CSM:dsg

Enclosures

cc: Dr. D.C. Wiggert

EPRI CONTRACT NUMBER RP 1 3 4 2 - 1	CONTRACTOR NAME AND ADDRESS Georgia Institute of Technology Atlanta, GA 30332
PERIOD OF PERFORMANCE From: 7 / 01 / 82 To: 7 / 31 / 82	

Refer to instructions on reverse side;
all figures are to be shown in whole thousands.

Actual
Incurred
cost in the
current year
19 ____

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Prior Year(s) Actual	(1)
1	1	1	2	2	3	3						90	
												Current Year Actual	
												13	(2)

Forecast to
complete the
current year
19 ____

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Current Year Forecast	(3)
							4	2	2	2	1	11	

Forecast to
complete the
future year(s)

19 83	19 ____	19 ____	19 ____	Remaining Year(s)	Future Year(s) Forecast	(4)
21					21	

Grand total of lines (1) + (2) + (3) + (4)

Contract cost limitation thru amendment no. ____

135

135

Remarks: Comment on significant changes.

Note: Contract cost limitation = (1) + (2) + (3) + (4); if not, an explanation is required.

W. Martin (Professor)
Signature and Title (contractor representative)

8/3/82
Date

Signature (EPRI project manager)

Date

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

SCHOOL OF
CIVIL ENGINEERING

TELEPHONE:
(404) 894-2224

August 31, 1982

Dr. J.S. Maulbetsch
Electric Power Research Institute
3412 Hillview Avenue
P.O. Box 10412
Palo Alto, CA 94303

Subject: Monthly Progress Report for EPRI Contract RP 1342-1
"Hydraulic Transients in Cooling Water Systems"

Dear Dr. Maulbetsch:

During the month of August 1982 effort was continued on the development of a computer code for the modelling of hydraulic transients in cooling water systems.

Regarding the three power stations for which we are obligated to simulate, the status is as follows:

<u>Plant</u>	<u>Information Status</u>
Shoreham (New York)	Complete
Grain (England)	Nearly complete
Torrens Island (Australia)	Missing pressure traces from UV recorder

Sincerely,

C.S. Martin
Professor

CSM:dg

Enclosure

cc: Dr. D.C. Wiggert

EPRI CONTRACT NUMBER RP 1 3 4 2 - 0 1	CONTRACTOR NAME AND ADDRESS Georgia Institute of Technology Atlanta, GA 30332
PERIOD OF PERFORMANCE From: 8 / 01 / 82 To: 8 / 31 / 82	

Refer to instructions on reverse side;
all figures are to be shown in whole thousands.

Actual -
Incurred
cost in the
current year
19 82

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Prior Year(s) Actual	(1)
1	1	1	2	2	3	3	3					90	
												Current Year Actual	(2)
												16	

Forecast to
complete the
current year
19

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Current Year Forecast	(3)
								2	2	2	1	7	

Forecast to
complete the
future year(s)

19 83	19	19	19	Remaining Year(s)	Future Year(s) Forecast	(4)
22					22	

Grand total of lines (1) + (2) + (3) + (4)

135

Contract cost limitation thru amendment no. _____

135

Remarks: Comment on significant changes.

Note: Contract cost limitation = (1) + (2) + (3) + (4); if not, an explanation is required.

L. J. [Signature] (Professor)
Signature and Title (contractor representative)

9/1/82
Date

Signature (EPRI project manager)

Date

E 20-650

GEORGIA INSTITUTE OF TECHNOLOGY

ATLANTA, GEORGIA 30332

SCHOOL OF
CIVIL ENGINEERING

October 7, 1982

TELEPHONE
(404) 894-

2224

Dr. J. S. Maulbetsch
Electric Power Research Institute
3412 Hillview Avenue
P. O. B ox 10412
Palo Alto, CA 94303

Subject: Monthly Progress Report for EPRI Contract RP 1342-1
"Hydraulic Transients in Cooling Water Systems"

Dear Dr. Maulbetsch:

During the month of September 1982 work continued on the enhancement of a computer code to simulate transients in the cooling water systems of Shoreham (New York), Grain (England) and Torrens Island (Australia).

Sincerely,



C. S. Martin
Professor

CSM/nb

EPRI CONTRACT NUMBER RP 1 3 4 2 - 0 1	CONTRACTOR NAME AND ADDRESS Georgia Institute of Technology Atlanta, GA 30332
PERIOD OF PERFORMANCE From: <u>9 / 01 / 82</u> To: <u>9 / 30 / 82</u>	

Refer to instructions on reverse side;
all figures are to be shown in whole thousands.

**Actual -
Incurred
cost in the
current year
19 ____**

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1	1	2	2	3	3	3	2			

Prior Year(s) Actual
90 (1)
Current Year Actual
18 (2)

**Forecast to
complete the
current year
19 ____**

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
									2	2	1

Current Year Forecast
5 (3)

**Forecast to
complete the
future year(s)**

19 <u>83</u>	19 ____	19 ____	19 ____	Remaining Year(s)
22				

Future Year(s) Forecast
22 (4)

Grand total of lines (1) + (2) + (3) + (4)

135
115

Contract cost limitation thru amendment no. 4

Remarks. Comment on significant changes.

Note: Contract cost limitation = (1) + (2) + (3) + (4); if not, an explanation is required.

Prof. A. (Professor) 10/4/82
Signature and Title (contractor representative) Date

Signature (EPRI project manager) Date

E-20-657

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

SCHOOL OF
CIVIL ENGINEERING

TELEPHONE
(404) 894-2244

February 22, 1983

E-20-650

Dr. J.S. Maulbetsch
Electric Power Research Institute
3412 Hillview Avenue
P.O. Box 10412
Palo Alto, CA 94303

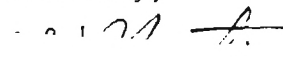
Subject: Progress Report for EPRI Contract RP 1342-1
"Hydraulic Transients in Cooling Water Systems"

Dear Dr. Maulbetsch:

Since the last reporting period work has continued on the enhanced of a computer code to investigate transients in cooling water systems, with the main emphasis directed toward the simplification of a model to represent the condenser.

This simplified model is being verified with test data from the cooling water system of Shoreham (New York), Grain (England), and Torrens Island (Australia).

Sincerely,


C.S. Martin
Professor

CSM:lyl

EPRI CONTRACT NUMBER RP 1 3 4 2 - 0 1	CONTRACTOR NAME AND ADDRESS Georgia Institute of Technology Atlanta, GA 30332 <div style="text-align: right; font-size: 1.2em; font-family: cursive;">E-20-650</div>
PERIOD OF PERFORMANCE From: <u>1</u> / <u>1</u> / 83 To: <u>1</u> / <u>30</u> / 83	

Refer to instructions on reverse side;
all figures are to be shown in whole thousands.

**Actual
Incurred
cost in the
current year
19 83**

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1											

Prior
Year(s)
Actual

109 (1)

Current
Year
Actual

1 (2)

**Forecast to
complete the
current year
19 83**

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1	2	1	2	5	5	5	4			

Current
Year
Forecast

26 (3)

**Forecast to
complete the
future year(s)**

19 ____	19 ____	19 ____	19 ____	Remaining Year(s)

Future
Year(s)
Forecast

0 (4)

Grand total of lines (1) + (2) + (3) + (4)

135
135

Contract cost limitation thru amendment no. ____

Remarks: Comment on significant changes.

Note: Contract cost limitation = (1) + (2) + (3) + (4); if not, an explanation is required.

C. J. ... Professor
Signature and Title (contractor representative)

1/12/83
Date

Signature (EPRI project manager)

Date

EPRI CONTRACT NUMBER RP <table border="1"> <tr> <td>1</td> <td>3</td> <td>4</td> <td>2</td> <td>-</td> <td>01</td> </tr> </table>	1	3	4	2	-	01	CONTRACTOR NAME AND ADDRESS Georgia Institute of Technology Atlanta, GA 30332
1	3	4	2	-	01		
PERIOD OF PERFORMANCE From: 11 / 01 / 82 To: 11 / 30 / 82							

Refer to instructions on reverse side;
all figures are to be shown in whole thousands.

Actual
Incurred
cost in the
current year
19 82

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1	1	2	2	3	3	2	1	1	1	

Prior
Year(s)
Actual

90

(1)

Current
Year
Actual

18

(2)

Forecast to
complete the
current year
19 ____

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Current
Year
Forecast

2

(3)

Forecast to
complete the
future year(s)

19 83	19 ____	19 ____	19 ____	Remaining Year(s)
25				

Future
Year(s)
Forecast

25

(4)

Grand total of lines (1) + (2) + (3) + (4)

135

Contract cost limitation thru amendment no. ____

135

Remarks: Comment on significant changes.

Note: Contract cost limitation = (1) + (2) + (3) + (4); if not, an explanation is required.

William / Professor
Signature and Title (contractor representative)

12/12/82
Date

Signature (EPRI project manager)

Date

EPRI CONTRACT NUMBER RP <table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td style="width: 20px; text-align: center;">1</td> <td style="width: 20px; text-align: center;">3</td> <td style="width: 20px; text-align: center;">4</td> <td style="width: 20px; text-align: center;">2</td> </tr> </table> <table border="1" style="display: inline-table; vertical-align: middle; margin-left: 10px;"> <tr> <td style="width: 20px; text-align: center;">0</td> <td style="width: 20px; text-align: center;">1</td> </tr> </table>	1	3	4	2	0	1	CONTRACTOR NAME AND ADDRESS Georgia Institute of Technology Atlanta, GA 30332
1	3	4	2				
0	1						
PERIOD OF PERFORMANCE From <u>10/01/82</u> To: <u>10/31/82</u>							

Refer to instructions on reverse side;
all figures are to be shown in whole thousands.

Actual -
Incurred
cost in the
current year
19 ____

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1	1	2	2	3	3	3	2	2		

Prior
Year(s)
Actual

90

(1)

Current
Year
Actual

20

(2)

Forecast to
complete the
current year
19 ____

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
										2	1

Current
Year
Forecast

3

(3)

Forecast to
complete the
future year(s)

19 83	19 ____	19 ____	19 ____	Remaining Year(s)
22				

Future
Year(s)
Forecast

22

(4)

Grand total of lines (1) + (2) + (3) + (4)

135

Contract cost limitation thru amendment no. 4

115

Remarks. Comment on significant changes.

Note. Contract cost limitation = (1) + (2) + (3) + (4), if not, an explanation is required.

[Signature] (Professor) 11/8/82
Signature and Title (contractor representative) Date

Signature (EPRI project manager) Date